ARGOS/EUVIP Data Development and Utilization

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LONG-TERM GOALS

My long term goal is to understand the density structure of the Earth's plasmasphere, and the physical processes that contribute to the formation of the plasmapause. Of particular interest is the coupling between the plsmasphere and the ionosphere, and the use of global helium images to obtain the density structure and to constrain any theoretical model.

OBJECTIVES

I wish to validate and refine my current model of the plasmasphere, the Multi-Species Kinetic Model of the Plasmasphere (MSKPM), using the data from the Extreme Ultraviolet Imaging Photometer (EUVIP) instrument on the Advanced Research and Global Observation Satellite (ARGOS). EUVIP will measure the 30.4 nm sunlight scattered by helium ions in the topside ionosphere and the plasmasphere. Inversion of this data (Meier, 1998) is necessary to recover the density structure and any parameters that govern the density structure.

APPROACH

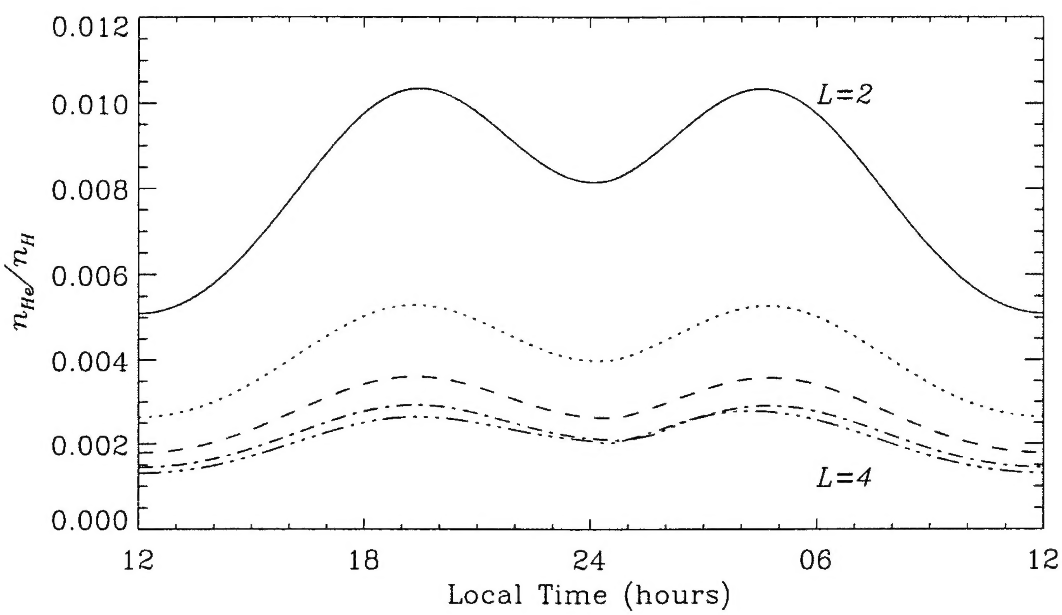
I will obtain the instrument data from the Naval Research Laboratory (NRL), which is analyzing the data from other instruments on the same satellite, and, with the assistance of Eric Korpela, the EUVIP project scientist at UC Berkeley, process the data for scientific analysis. In addition, I will incorporate realistic boundary conditions into MSKPM by using the exobase model being investigated at NRL as well as the global MHD model that was developed at NRL. My graduate student at Howard University, Kyndall Barry, will be responsible for processing the EUVIP data, comparing it to the model MSKPM, and improving the model. Guru Ganguli at NRL, and Daniel Melendez at NOAA (formerly of NRL) will also collaborate on the theoretical issues.

WORK COMPLETED

I have obtained some of the data processing algorithms from Eric Korpela, and have applied them to preliminary EUVIP data. I am currently working on obtaining the EUVIP data in a regular fashion. In addition, I have added a realistic lower boundary condition to MSKPM. Preliminary results of this work were presented at the AGU Spring Meeting in June 1999 and the 26th General Assembly of the International Radio Science Union in Toronto, Canada, August 1999 (see the Reference section).

RESULTS

I have shown that a local-time dependent exobase can be quite important in determining the density structure of the plasmasphere. An altitude and density variation on the order of 100% can be strong enough to swamp the effects of diurnal convection. An example is shown in the figure below. This figure depicts the helium-to-hydrogen density ratio as a function of local time for five evenly spaced equatorial altitudes between *L=2* and *L=4*. The strong variation of this ratio, which is needed to infer the hydrogen density from the remotely sensed helium density, shows that the exobase variation is important to include. This work was presented at the AGU Spring Meeting in June 1999 and the 26th General Assembly of the International Radio Science Union in Toronto, Canada, August 1999, and also has been submitted to the Journal of Atmospheric and Solar-Terrestrial Physics. I have achieved no results with regard to the EUVIP instrument as the data is still in the process of being downloaded and analyzed.



1. Helium-to-hydrogen density ratio as a function of local time at five equally spaced altitudes between L=2 and L=4 as calculated by MSKPM using the parameterized exobase from FLIP. See the Publications section for the reference information.

IMPACT/APPLICATIONS

An accurate model of the density, composition, and temperature structure of the plasmasphere is necessary to interpret the results of NASA's IMAGE satellite, which will be launched in 2000, and which will also measure the helium density, but from a global perspective. In addition, this kind of first-principles model will greatly enhance the understanding of space weather as it applies to the plasmasphere.

TRANSITIONS

This model will ultimately be parameterized into an operational model that space weather forecasters will be able to use to predict the impact on Earth of conditions in space.

RELATED PROJECTS

A detailed quantitative investigation of the boundary between the collisionless (high altitude) region of the plasmasphere and the collisional (low altitude) region of the plasmasphere and topside ionosphere is currently being undertaken by Daniel Melendez at NOAA (formerly at NRL). This boundary, called the exobase, is being calculated using the numerical fluid code FLIP (Field Line Interhemispheric Plasmasphere model).

REFERENCES

Meier, R. R., A. C. Nicholas, J. M. Picone, D. J. Melendez-Alvira, G. Ganguli, M. A. Reynolds, and E. C. Roelof, "Inversion of plasmaspheric EUV remote sensing data from the STP 72-1 satellite," *J. Geophys. Res.* **103**, 17505-17518 (1998).

AGU Spring Meeting, June 1999

"Terrestrial Ion Exobase Calculations," by D. J. Melendez-Alvira, M. A. Reynolds, G. Ganguli, and R. R. Meier

"Plasmasphere Model with Convection," by M. A. Reynolds, G. Ganguli, R. R. Meier, and D. J. Melendez-Alvira

26th General Assembly of the International Radio Science Union,Toronto, Canada, August 1999

"Plasmasphere Model with Convection," by M. A. Reynolds and G. Ganguli

PUBLICATIONS

Reynolds, M. A., D. J. Melendez-Avira, and G. Ganguli, "Equatorial coupling between the plasmasphere and the topside ionosphere," submitted to the *Journal of Atmospheric and Solar-Terrestrial Physics*, October 1999.

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14. ABSTRACT
The initial work performed under the "ARGOS/EUVIP Data Development and Utilization" grant is detailed in this annual report. Theoretical work on the coupling between the plasmasphere and the ionosphere was initiated. Analysis of the data from the EUVIP instrument was begun.

15. SUBJECT TERMS
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